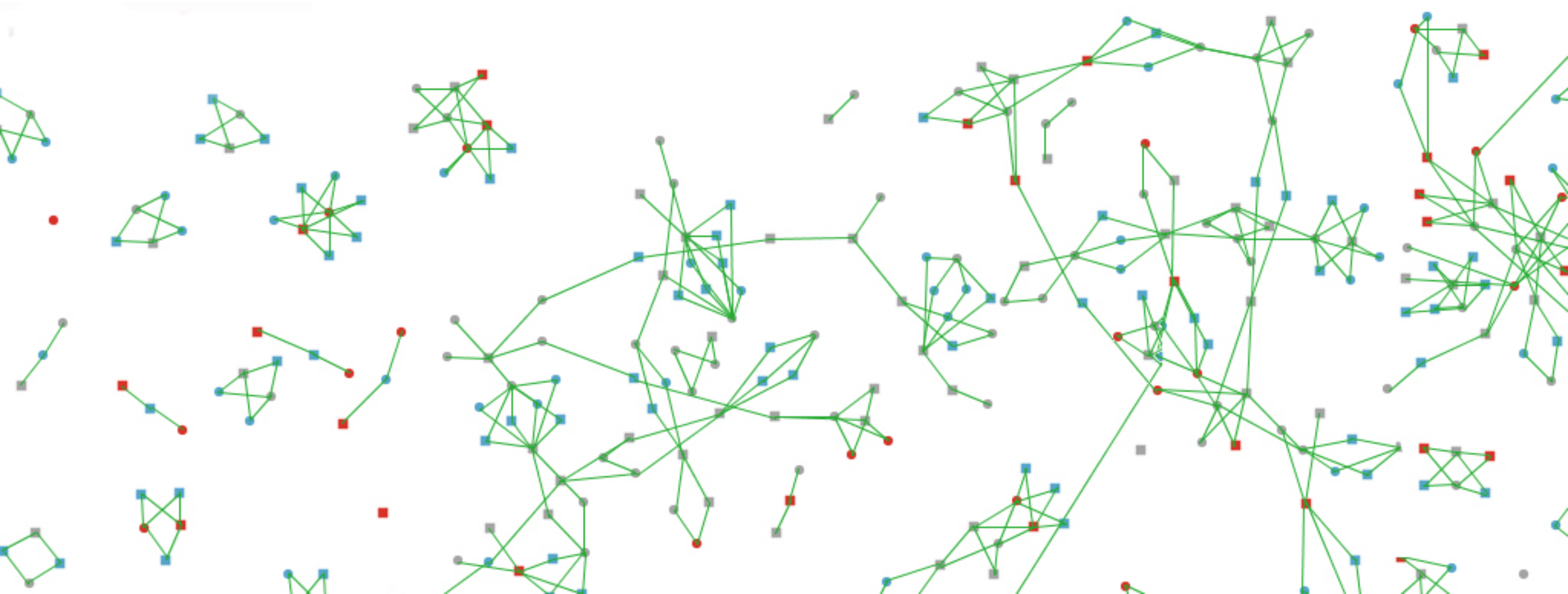
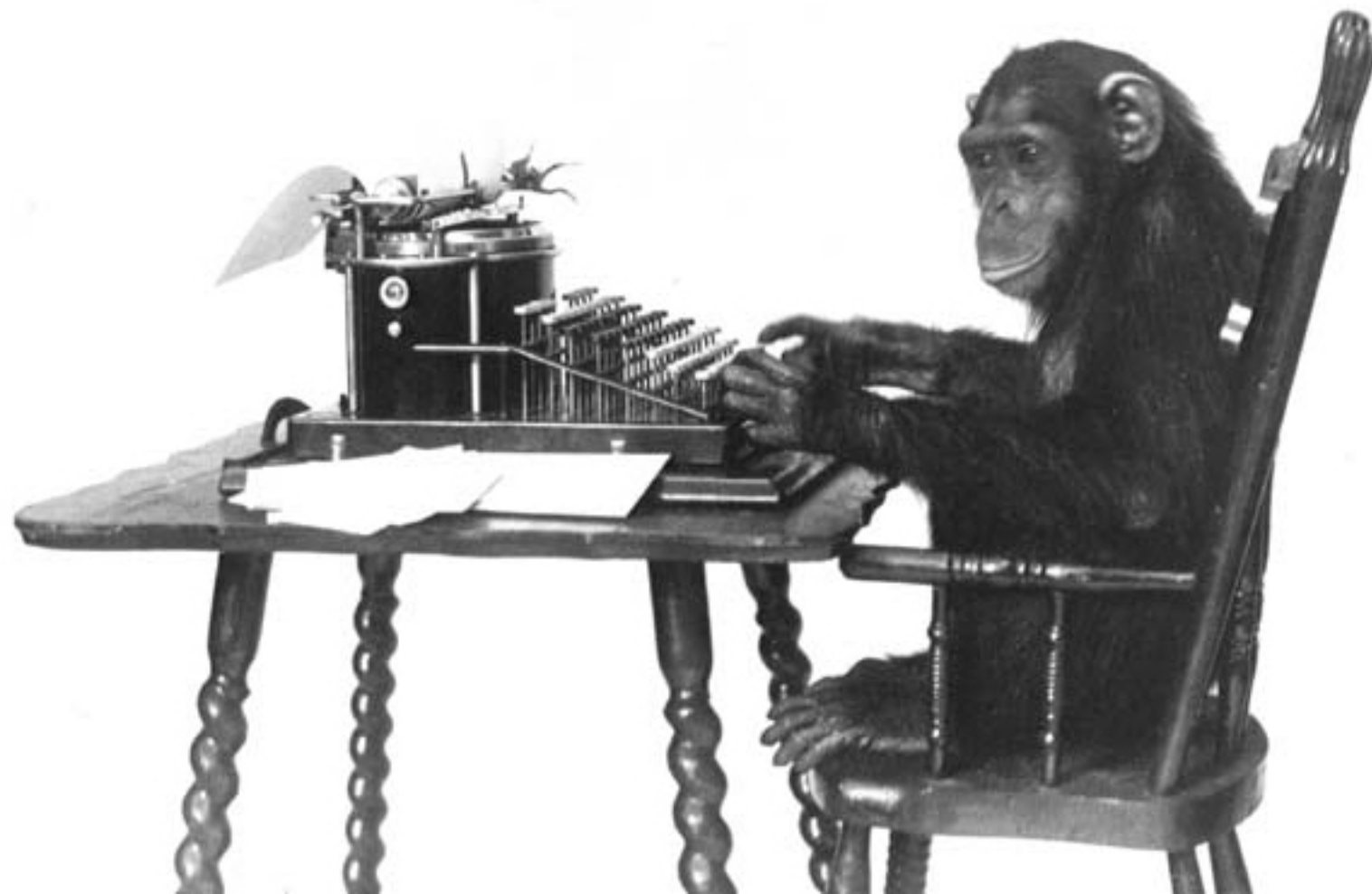


Scaling in the Community Structure of Networks

Aaron L Bramson



A NetLogo Computer Model to Test
Genetic Distance as a Sufficiency Conditions for
Reproducing the Same Statistical Properties
as Actual Data from Hunter-Gatherer Societies
Regarding the Power Law Distribution
of the Scaling Factor of Group Sizes



The Problem:

- Non-Spatial Model
- Genetic Distance is 1D parameter
- Need to Measure Community Structure



The Solution:

Build a Network Model!

- Edges (and their weights) can be ANYTHING!
- Maps 1D parameters in n-Dimensional space
- Several off-the-shelf measures available
- Networks are sexy, fun, and fashionable

Model Description

1. Initial population is 50:50 Male:Female; Ages uniform 0 to age-at-first-birth;
No genetic relations
2. When females come of age the hunt for an of-age single male whose genetic relation is no greater than the amount specified
3. If such a male is available, then they marry and have a defined probability of having a baby (50:50 Male:Female)
4. This continues throughout the females' child-bearing years
5. Agents die when they are told (same for everybody)

Choose a platform



- Repast

- Mathematica

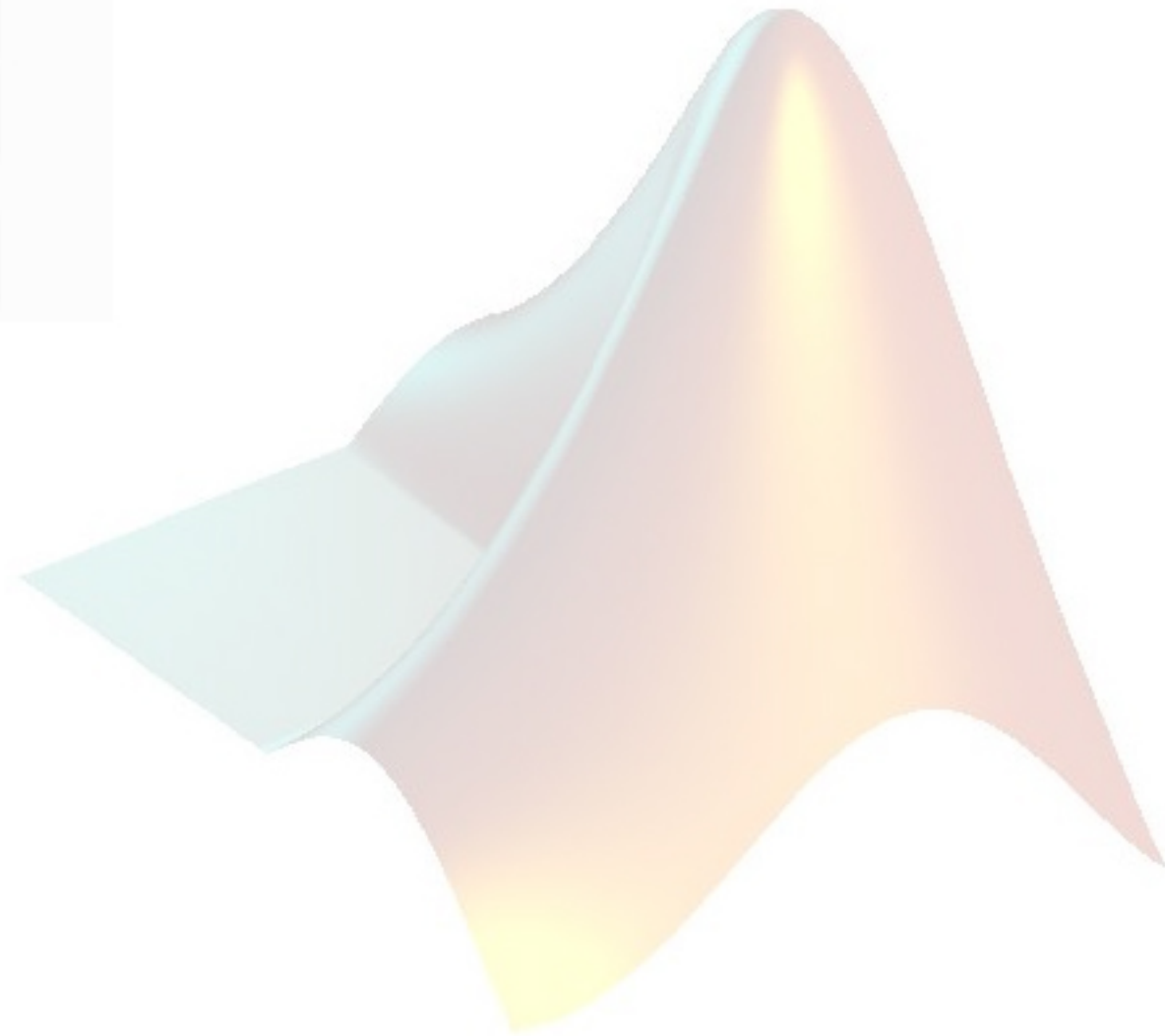
- Matlab

- NetLogo

Introducing
MATHEMATICA⁵

Introducing TO

Featuring a new generation of
advanced algorithms with unparalleled
speed, scope, and scalability •



NetLogo



Choose the Parameters

number-of-nodes 13

age-at-first-birth 16

age-of-death 49

child-bearing-years 8

prob-of-birth 0.35

min-gen-dist 0.12

☒ On ☐ Off display-edges?

☒ On ☐ Off display-matrix?

spring-force 0.3

mutual-repulsion 1.50


tick	edges
50	37

population	corpses
27	13

female pop	male pop
15	12

No Hidden Parameters





Implementation in NetLogo

Innovation is 1% inspiration

and

99% perspiration - for

me

it

was

at

least

twice

that.

Building the Adjacency Matrix

- NetLogo does not have 2D arrays
- Closest thing is lists of lists
- Only a psychotic moron with masochistic tendencies and hours and hours to waste would even try to use NetLogo to implement an adjacency matrix.

I pity the fool
who use NetLogo!



For the Love of Loops and Lists

```
hunt-for-mate ;women of-age look for unmarried of-age men
cals [distances best-mate best-value fertile-females]
ask nodes with [married = 0 and sex = 0 and age >= age-at-first-birth and age < (age-at-first-birth + child-age-at-first-birth)] [self-ID] fertile-females
without-interruption [
  set fertile-females []
  set mates []
  set distances []
  set best-mate 0
  set fertile-females lput values-from nodes with [sex = 0 and married = 0 and age >= age-at-first-birth] [self-ID] fertile-females
  set mates lput values-from nodes with [sex = 0 and married = 0 and age >= age-at-first-birth] [self-ID] mates ;create list of potent
  set mates item 0 mates
  set fertile-females item 0 fertile-females
  ;show fertile-females
  ;show mates
  ifelse mates = []
  [
    [foreach mates [set distances lput (find-distance (self) (one-of nodes with [self-ID = ?])) distances]
    set best-value item 0 filter [? <= min-gen-dist] distances
    set best-mate item (position best-value distances) mates
    ;show best-mate
    ifelse fertile-females = []
    [
      [ask one-of nodes with [self-ID = item 0 fertile-females] [
        set married 1
        set mate-ID best-mate
        spawn]]
      ask one-of nodes with [self-ID = best-mate] [
        set mate-ID self-ID
        set married 1]
    ]
  ]
end]
```

- No nested *for loops*

- Synchronous, not serial, activation of “turtles”

- My favorite part of building this model was when both men and women were all marrying the same man (who was married to himself) and everybody was giving birth to pregnant babies

Deep Thoughts

by Jack Handey

I believe in making the world safe for our children,
but not our children's children,
because I don't think children should be having sex.

The Legend of Hunter-Gatherer Societies

Male

Females



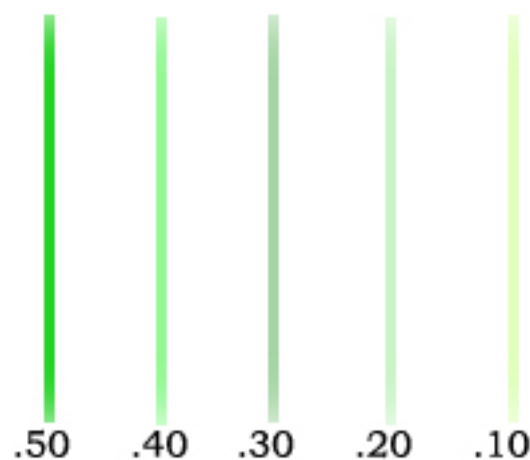
Under age-at-first-birth



Fertile Years



Over the Hill



Genetic Relation

Made it to Third Base

- Became intimately familiar with NetLogo
- Unfortunately, I did not make it “all the way”
- No reason to continue developing the model
- Donate code to the modelling community

